Claims

Claimed is:

1. A multi-stage automatic transmission, with an input drive shaft (AN), and an output drive shaft (AB), at least three single planetary gear sets (RS1, RS2, RS3), as well as at least three shifting elements (a to E), wherein:

- the three planetary gear sets (RS1, RS2, RS3) are aligned coaxially to one another,
- the second planetary gear set (RS2), as seen spatially, is placed between the first and the third planetary gear sets (RS1, RS3),
- one sun gear (SO3) of the third planetary gear set (RS3) is secured above the first shifting element (A) an a transmission housing (GG) of the multi-stage automatic transmission,
- the input drive shaft (AN) is connected with a sun gear (SO2) of the second planetary gear set (RS2),
- the input drive shaft (AN) is connected by means of the second shifting element (B) with a sun gear (SO1) of the first planetary gear set (RS1) and/or by means of the fifth shifting element (E) with a spider (ST1) of the first planetary gear set (RS1),
- alternatively, the sun gear (SO1) of the first planetary gear set (RS1) is affixed by means of the third shifting element (C) and/or the spider (ST1) of the first planetary gear set (RS1) by means of the fourth shifting element (D) on the transmission housing (GG),
- the output drive shaft (AB) is connected with an internal gear HO1 of the first planetary gear set (RS1) and with one of the spiders (ST2, ST3) of the second or the third planetary gear set (RS2, RS3)

therein characterized, in that the first planetary gear set (RS1) and/or the second planetary gear set (RS2) are centrally and completely penetrated in the axial direction by a shaft.

2. A multi-stage automatic transmission in accord with claim 1, therein characterized, in that the shaft, which penetrates the first and/or the second planetary gear set (RS1, RS2) in an axial direction is the input drive shaft (AN).

3. A multi-stage automatic transmission in accord with claim 1 or claim 2, therein characterized, in that the fifth shifting element (E), as seen spatially, is placed between the first and the second planetary gear set (RS1, RS2),

4. A multi-stage automatic transmission in accord with claim 1, 2 or 3, therein characterized, in that the connective element between the spider (ST1) of the first planetary gear set (RS1) and the internal gear (HO2) of the second planetary gear set (RS2) are simultaneously a disks carrier of the fifth shifting element.

5. A multi-stage automatic transmission in accord with claim 4, therein characterized, in that the combining element between the spider (ST1) of the first planetary gear set (RS1) and he internal gear (HO2) of the second planetary gear set (RS2) is designed as an outside disks carrier for the acceptance of friction disks of the fifth shifting element (E).

6. A multi-stage automatic transmission in accord with one of the claims 1 to 5, therein characterized, in that the second shifting element (B) is placed upon that side of the first planetary gear set (RS1) which lies opposite to the fifth shifting element (E).

7. A multi-stage automatic transmission in accord with one of the claims 1 to 6, therein characterized, in that the third and fourth shifting element (C, D), as seen spatially, is placed upon that side of the first planetary gear set (RS1) which lies opposite to the fifth shifting element (E).

8. A multi-stage automatic transmission in accord with claim 6 and 7, therein characterized in that the second, third and fourth shifting elements (B, C, D) are placed on one side of the first planetary gear set (RS1), which side is proximal to a motor of the multi-stage automatic transmission which is operationally connected to the input drive shaft (AN).

9. A multi-stage automatic transmission in accord with one of the claims 1 to 6, therein characterized in that the third and fourth shifting element (C, D) are placed next to one another, as seen in the axial direction and are in a zone radially located above the planetary gear sets (RS1, RS2, RS3).

10. A multi-stage automatic transmission in accord with claims 1 to 9, therein characterized in that a servo apparatus (510) of the fifth shifting element (E) is located on the shaft, which centrally penetrates the first planetary gear set (RS1), especially the input drive shaft (AN).

11. A multi-stage automatic transmission in accord with one of the claims 1 to 10, therein characterized in that the servo apparatus (510) of the fifth shifting element (E) activates the disks (500) of the fifth shifting element (E) axially in the direction of the first planetary gear set (RS1).

12. A multi-stage automatic transmission in accord with one of the claims 1 to 10, therein characterized in that the servo apparatus (510) of the fifth shifting element (E) activates the disks (500) of the fifth shifting element (E) axially in the direction of the second planetary gear set (RS2).

13. A multi-stage automatic transmission in accord with one of the claims 1 to 12, therein characterized in that the servo apparatus (210) of the second shifting element (B) is place nearer to the first planetary gear set (RS1) than is a servo apparatus (310) of the third shifting element (C).

14. A multi-stage automatic transmission in accord with one of the claims 1 to 13, therein characterized in that a servo apparatus (210) of the second shifting element (B) is placed immediately proximal to the first planetary gear set (RS1).

15. A multi-stage automatic transmission in accord with one of the claims 1 to 14, therein characterized in that the servo apparatus (210) of the second shifting element B activates the disks (200) of the second shifting element (210) axially in a direction contrary to the first planetary gear set (RS1).

16. A multi-stage automatic transmission in accord with one of the claims 1 to 13, therein characterized in that a servo apparatus (210) of the second shifting element (B) is placed immediately proximal to a transmission housing affixed wall (GW), which forms an outer wall of the transmission housing (GG).

17. A multi-stage automatic transmission in accord with one of the claims 1 to 13 or 16, therein characterized in that the servo apparatus (210) of the second shifting element (B) activates the disks (200) of the second shifting element (B) axially in the direction of the first planetary gear set (RS1).

18. A multi-stage automatic transmission in accord with one of the claims 1 to 17, therein characterized in that a servo apparatus (210) of the second shifting element (B) is bearingly supported on sun gear (SO1) of the first planetary gear set (RS1).

19. A multi-stage automatic transmission in accord with one of the claims 1 to 17, therein characterized in that the servo apparatus (210) of the second shifting element (B) is bearingly supported on the shaft, which centrally penetrates the first planetary gear set (RS1), in particular, the input drive shaft (AN).

20. A multi-stage automatic transmission in accord with one of the claims 1 to 19, therein characterized in that a servo apparatus (310) of the third shifting element (C) and/or a servo apparatus (410) of the fourth shifting element (D), is integrated, at the least, in a far ranging manner, in a transmission-housing affixed housing wall (GW), which forms an outside wall of the transmission housing (GG).

21. A multi-stage automatic transmission in accord with one of the claims 1 to 20, therein characterized in that a servo apparatus (310) of the third shifting element (C) is placed radially underneath the servo apparatus (410) of the fourth shifting element (D).

22. A multi-stage automatic transmission in accord with one of the claims 1 to 21, therein characterized in that disks (300, 400) of the third and fourth shifting elements (C, D) border axially on the housing wall (GW).

23. A multi-stage automatic transmission in accord with one of the claims 1 to 22, therein characterized in that disks (200) of the second shifting element (B) are placed closer to the first planetary gear set (RS1) than are the disks (400) of the fourth shifting element (D).

24. A multi-stage automatic transmission in accord with one of the claims 1 to 23, therein characterized in that disks (300) of the third shifting element (C) are placed radially underneath the disks (400) of the fourth shifting element (D).

25. A multi-stage automatic transmission in accord with one of the claims 1 to 21, therein characterized in that disks (200, 300) of the second and third shifting element (B, C) border axially on the housing wall (GW).

26. A multi-stage automatic transmission in accord with one of the claims 1 to 21 or 25, therein characterized in that disks (400) of the fourth shifting element (D) are placed nearer to the first planetary gear set (RS1) than are the disks (200) of the second shifting elements (B).

27. A multi-stage automatic transmission in accord with one of the claims 1 to 21, 25 or 26, therein characterized in that disks (300) of the third shifting element (C) are placed radially underneath the disks (200) of the second shifting element (B).

28. A multi-stage automatic transmission in accord with one of the claims 1 to 21 or 25 to 28, therein characterized in that an activation stamp (416) of the servo apparatus (410) of the fourth shifting element (D) partially overlaps the disks (200) of the second shifting element (B) in a radial direction.

29. A multi-stage automatic transmission in accord with one of the claims 1 to 21, or 25 to 28, therein characterized in that the activation stamp (416) of the servo apparatus (410) of the fourth shifting element (D) partially overlaps the servo apparatus (210) of the second shifting element (B) in the axial direction.

30. A multi-stage automatic transmission in accord with claim 28 or 29, therein characterized, in that the activation stamp (416) of the servo apparatus (410) of the fourth shifting element (D) penetrates a restorative element (413) of the servo apparatus (410) of the fourth shifting element (D) in the axial direction.

31. A multi-stage automatic transmission in accord with claims 1 to 30, therein characterized, in that the servo apparatus (410) of the fourth shifting element (D) possesses two pressure spaces (411a, 411b), wherein the differential pressure between the two acts upon the disks (400) of the fourth shifting element (D).

32. A multi-stage automatic transmission in accord with claims 28 or 31 or in accord with claims 29 and 31, therein characterized, in that the second pressure space (411b) of the servo apparatus (410) of the fourth shifting element (D) is formed by the construction of a section of the transmission housing (GG) and the

activation stamp (416) of the servo apparatus (410) of the fourth shifting element (D).

33. A multi-stage automatic transmission in accord with one of the claims 1 to 21, therein characterized, in that the disks (200, 300, 400) of the second, third and fourth shifting elements (B, C. D) border axially on the housing wall (GW).

34. A multi-stage automatic transmission in accord with one of the claims 1 to 21 or 32, therein characterized, in that the disks (300) of the third shifting element (C) are placed radially underneath the disks (200) of the second shifting element (B) and the disks (200) of the second shifting element (B) is placed radially under the disks (400) of the fourth shifting element (D).

35. A multi-stage automatic transmission in accord with one of the claims 1 to 34, therein characterized, in that the friction disks of the third shifting element (C) and/or the friction disks of the fifth shifting element (E) possess a come-along toothing on their outer diameter.

36. A multi-stage automatic transmission in accord with the claims 1 to 6 or 9 to 16, therein characterized, in that disks (300) of the third shifting element (C) are placed nearer to the second shifting element (B) than are the disks (400) of the fourth shifting element (D).

37. A multi-stage automatic transmission in accord with one of the claims 1 to 6, 9 to 19 or 36, therein characterized, in that a servo apparatus (310) of the third shifting element (C) and/or a servo apparatus (410) of the fourth shifting element (D) is integrated into the transmission housing (GG) or is integrated into a disks carrier of the third/fourth shifting element (C, D) which said carrier is non-rotatably affixed to the transmission housing (GG).

38. A multi-stage automatic transmission in accord with one of the claims 1 to 6, 9 to 19, 36 or 37, therein characterized, in that the servo apparatus (310) of the third shifting element (C) activates the disks (300) of the third shifting element (C) axially in the direction of the second shifting element (B).

39. A multi-stage automatic transmission in accord with one of the claims 1 to 6, 9 to 19, or 36 to 38, therein characterized, in that the servo apparatus (310) of the third shifting element (C) activates the disks (300) of the third shifting element (C) axially in th direction of the second shifting element (B).

40. A multi-stage automatic transmission in accord with one of the claims 1 to 6, 9 to 19, or 36 to 39, therein characterized, in that the servo apparatus (310) of the third shifting element (C) possesses an activation direction counter to the servo apparatus (410) of the fourth shifting element (D).

41. A multi-stage automatic transmission in accord with one of the claims 1 to 40, therein characterized, in that the first shifting element (A), when seen spatially, is placed on that side of the third planetary gear set (RS3) which is remote from the second planetary gear set (RS2).

42. A multi-stage automatic transmission in accord with Claim 41, therein characterized, in that the first shifting element (A) borders onto the third planetary gear set (RS3).

43. A multi-stage automatic transmission in accord with one of the claims 1 to 42, therein characterized, in that the first shifting element (A) is non-rotatably bound onto an outside wall of the transmission housing (GG) or is so bound on a transmission housing (GG) cover and thus forms an outer wall of the said automatic transmission.

44. A multi-stage automatic transmission in accord with one of the claims 1 to 43, therein characterized, in that an outside disks carrier of the first shifting element (A) is integrated into the transmission housing (GG) or into a transmission housing cover which is non-rotatably affixed to the transmission housing (GG).

45. A multi-stage automatic transmission in accord with one of the claims 41 to 44, therein characterized, in that a servo apparatus (110) of the first shifting element (A) is integrated into the transmission housing (GG) or is integrated into a transmission housing wall affixed to said transmission housing.

46. A multi-stage automatic transmission in accord with one of the claims 1 to 45, therein characterized, in that a total of eight axial bearings (AX1 to AX8) are provided for the axial support of components which are located within the transmission housing GG.

47. A multi-stage automatic transmission in accord with claim 46, therein characterized, in that axial bearings (AX1 to AX8) are provided in two different sizes.

48. A multi-stage automatic transmission in accord with one of the claims 1 to 47, therein characterized, in that within the transmission housing (GG), a total of four rotating sealing rings (RR1 to RR4) are provided for the dynamic sealing of individual pressure and lubrication medium feed means from one another and from other components.

49. A multi-stage automatic transmission in accord with one of the claims 1 to 48, therein characterized, in that the input drive shaft (AN) and the output drive shaft (AB) are aligned coaxially to one another.

50. A multi-stage automatic transmission in accord with claim 48, therein characterized, in that the output drive shaft (AB), which is operationally bound to the interior gear (HO1) of the first planetary gear set (RS1) centrally penetrates through the third planetary gear set (RS3) in the axial direction.

51. A multi-stage automatic transmission in accord with claim 49 or 50, therein characterized, in that the output drive shaft (AB), which is operationally bound to the interior gear (HO1) of the first planetary gear set (RS1) centrally penetrates, in an axial direction, a clutch space of the first shifting element (A), which space is particularly formed by a disks carrier and/or the servo apparatus (110) of the first shifting element (A).

52. A multi-stage automatic transmission in accord with claim 49, 50 or 51, therein characterized, in that the input drive shaft (AN) is bearingly supported within the output drive shaft (AB).

53. A multi-stage automatic transmission in accord with one of the claims 1 to 48, therein characterized, in that the input drive shaft (AN) and the output drive shaft (AB) do not run coaxial to one another, especially in that the input drive shaft (AN) and the output drive shaft (AB) run axis-parallel to one another or are set at an angular disposition.

54. A multi-stage automatic transmission in accord with claim 53, therein characterized, in that to accomplish the operational connection between the output drive shaft (AB) and the internal gear (HO1) of the first planetary gear set (RS1) at least one first spur gear (STR1) is provided, which, spatially seen, is placed in

the zone radially above the first and/or the second/ and or the third planetary gear set (RS1, RS2, RS3).

55. A multi-stage automatic transmission in accord with claim 53, therein characterized, in that to achieve an operational connection between the output drive shaft (AB) and the internal gear (HO1) of the first planetary gear set (RS1), at least one first spur gear (STR1) is provided, which, spatially observed, is placed axially between the third planetary gear set (RS3) and the first shifting element (A).

56. A multi-stage automatic transmission in accord with claim 53, therein characterized, in that to achieve an operational connection between the output drive shaft and the internal gear (HO1) of the first planetary gear set (RS1), at least a first spur gear (STR1) is provided, which when spatially observed, is placed axially between the first shifting element (A) and an outer wall of the transmission housing (GG), that is to say, axially between the first shifting element (A) and a transmission housing cover which is non-rotatably affixed to the transmission housing (GG).

57. A multi-stage automatic transmission in accord with claim 53 or 56, therein characterized, in that for the achievement of an operational connection between that output drive shaft (AB) and the internal gear (HO1) of the first planetary gear set (RS1), at least one first spur gear (STR1) is provided, which, when spatially observed, borders axially onto a outer wall of the transmission housing (GG), that is to say, borders onto transmission housing cover, which cover is non-rotatably bound to the transmission housing (GG).

58. A multi-stage automatic transmission in accord with one of the claims 1 to 57, therein characterized in that the internal gear (HO1) of the first planetary gear set (RS1) and the spider (ST3) of the third planetary gear set (RS3) and the output drive shaft (AB) are continually in contact with one another, and in that the spider (ST2) of the second planetary gear set (RS2) is continually bound with an internal gear (HO3) of the third planetary gear set (RS3) and further, in that the spider (ST1) of the first planetary gear set (RS1) is continually bound to an internal gear (HO2) of the second planetary gear set (RS2).

59. A multi-stage automatic transmission in accord with one of the claims 1 to 57, therein characterized, in that the internal gear (HO1) of the first planetary gear set (RS1) and the spider (ST2) of the second planetary gear set (RS2) and the output drive shaft (AB) are continually connected with one another and in that the spider (ST3) of the third planetary gear set (RS3) is continually bound with an internal gear (HO2) of the second planetary gear set (RS2) and in that the spider (ST1) of the first planetary gear set (RS1) is continually in contact with an internal gear (HO3) of the third planetary gear set (RS3).

60. A multi-stage automatic transmission in accord with one of the claims 1 to 59, therein characterized, in that by means of selective closure of the shifting elements (A to E) at least six forward gears may be shifted into, and in that for the re-shifting from one gear to the next successive higher gear, or to the next successive lower gear, from the existing active shifting element, respectively one shifting element is opened and another shifting element is closed.

61. A multi-stage automatic transmission in accord with one of the claims 1 to 60, therein characterized, in that in the shifting elements are closed as follows: in the first forward gear, the first and fourth shifting elements (A, D), in the second forward gear, the first and third shifting elements (A, C) and in the third forward gear, the first and second shifting element (A, B), in the fourth forward gear, the first and fifth shifting element (A, E), in the fifth forward gear, the second and fifth shifting element (B, E), in the sixth forward gear, the third and fifth shifting element (C, E), and in reverse gear, the second and fourth shifting element (B, D).